

SECTION 212 - GUIDELINES FOR ULTRATHIN BONDED WEARING COURSE SPECIFICATIONS

ITEM:

Ultrathin Bonded Wearing Course

1. Description

This specification covers the requirements for the placement of an Ultrathin Bonded Wearing Course and shall consist of application of a warm Polymer Modified Emulsion Membrane followed immediately with an ultrathin overlay of hot asphalt concrete. The Polymer Modified Emulsion Membrane shall be spray applied immediately prior to the application of the hot asphalt concrete overlay so as to produce a homogeneous wearing surface that can be opened to traffic immediately upon sufficient cooling. The finished wearing course shall have a minimum thickness of 1/2" for Type A, 5/8" for Type B, and 3/4" for Type C.

2. Materials

A. Coarse Aggregate

The coarse aggregates selected should be those typically used for high performance surfaces. Coarse aggregate should meet the skid resistance criteria as set forth by the specifying agency or have a history of successful use in surface mixes. Coarse aggregates, material retained above the #4 sieve, shall be from approved sources and shall meet the requirements listed in Table 1.

Coarse aggregates, such as crushed gravel, limestone, dolomite, sandstone, granite, chert, traprock, ore tailings, slag, or other similar materials, or blends of two or more of the above may be acceptable. When coarse aggregates for these mixes are from more than one source or of more than one type of material, they shall be proportioned and blended to provide a uniform mixture if approved by the Engineer.

Table 1 - Coarse Aggregate – Properties*		
TESTS	Method	Limit
Los Angeles abrasion value, % loss	AASHTO T 96-94	35 max
Flat & Elongated Ratio, % @ 3:1	ASTM D 4791	25 max
% Crushed, single face	ASTM D 5821	100 min
% Crushed, two faces	ASTM D 5821	85 min
Micro-Deval, % loss	AASHTO TP58-99	18 max

*All testing must be performed by an AMRL inspected laboratory or be an agency certified laboratory.

B. Fine Aggregate

The fine aggregates will be part of the asphalt mastic. The fine aggregate passing the #4 sieve shall be from approved sources and shall meet the requirements of Table 2.

Table 2 - Fine Aggregate – Properties*		
TESTS	Method	Limit
Sand Equivalent	AASHTO T 176-86	45 min
Methylene Blue (on materials passing 200)	AASHTO TP 57-99	10 max
Uncompacted Void Content	AASHTO T 304-96	40 min

*All testing must be performed by an AMRL inspected laboratory or be an agency certified laboratory.

C. Mineral Filler

Mineral filler may be used as an option to aid in meeting the gradation requirements. Hydrated Lime, certain classes of fly ash, and Type 1 Portland cement are acceptable as mineral filler. Mineral fillers shall meet the requirements in Table 3.

Table 3 – Mineral Filler Requirement*	
Typical acceptable gradation:	
100% passing #30 sieve	
75-100% passing #200 sieve	

*All testing must be performed by an AMRL inspected laboratory or be an agency certified laboratory.

D. Asphalt Binder

The asphalt binder shall meet the SuperPave requirements for **PG70-22 or PG76-22 (where state agencies normally specify PGxx-28 for their high volume roads, the binder may be PG70-28 or PG76-28)** and shall meet the requirements of Table 4:

Table 4 – Asphalt Binder Requirement			
Tests	Method	Min.	Max.
Separation Test, %	AASHTO PP-5		10
Elastic Recovery Test, %	ASTM D6084	60	

E. Polymer Modified Emulsion Membrane

The emulsion shall be polymer modified and shall be in accordance with Table 5:

Table 5 – Polymer Modified Emulsion Membrane Requirements			
Tests on Emulsion	Method	Min.	Max.
Viscosity, Saybolt Furol @ 122°F , s	AASHTO T59	25	125
Storage Stability Test ¹ , 24 h, %	AASHTO T59		1
Sieve Test ²	AASHTO T59		0.05

Residue by Distillation ³ , %		AASHTO T59	63	
Oil Distillate by Distillation, %		AASHTO T59		2
Demulsibility, %	35 ml, 0.02 N CaCl ₂ <u>or</u>	AASHTO T59	60	
	35 ml, 0.8% dioctyl sodium sulfosuccinate	AASHTO T59		
Tests on Residue From Distillation				
Penetration		AASHTO T49	90	150
Solubility in Organic Solvent ⁴ , %		AASHTO T44	97.5	
Elastic Recovery, %		AASHTO T301	60	
¹ Note: After standing undisturbed for 24 hours, the surface shall show no white, milky colored substance, but shall be a smooth homogeneous color throughout.				
² Note: The sieve test is waived if successful application of the material has been achieved in the field.				
³ Note: AASHTO T59 with modifications to include a 400°F ± 10°F maximum temperature to be held for a period of 15 minutes.				
⁴ Note: The organic solvent shall be approved by the Engineer as suitable. The test may be waived by the Engineer.				

3. Mix Design

The contractor shall formulate and submit a job mix formula (JMF) that satisfies the design general limits listed in Table 6 - Mixture Requirements.

Table 6 - Mixture Requirements*			
Composition by weight percentages			
Sieves	#4 - Type A	3/8" - Type B	1/2" - Type C
ASTM	Design General Limits % Passing	Design General Limits % Passing	Design General Limits % Passing
¾ in			100
½ in		100	85 - 100
3/8 in	100	75 - 100	60 - 80
#4	40 - 55	25 - 38	28 - 38
#8	22 - 32	19 - 27	25 - 32
#16	15 - 25	15 - 23	15 - 23
#30	10 - 18	10 - 18	10 - 18
#50	8 - 13	8 - 13	8 - 13
#100	6 - 10	6 - 10	6 - 10
#200	4 - 5.5	4 - 5.5	4 - 5.5
Asphalt Content, %	5.0 - 5.8	4.8 - 5.6	4.6 - 5.6
* All testing must be performed by an AMRL inspected laboratory or be an agency certified laboratory			

The film thickness shall be 9 – 11 microns when calculated using the effective asphalt content in conjunction with the surface area for the aggregates in the JMF. The surface area factors can be found in Table 6.1 of the Asphalt Institute MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types".

The mix design shall determine the target application **range**. The limits of the target application rate of the asphalt emulsion shall be 0.20 ± 0.07 gal/sq yd.

Drain down from the loose mixture shall not exceed 0.10% when tested in accordance with AASHTO T305. The draindown shall be tested at optimum

asphalt content plus 0.5%. The temperature shall be the mixing temperature plus 27°F.

The tensile strength shall meet or exceed 80% when tested in accordance with AASHTO T-283. Specimens for AASHTO T-283 shall be 4 in diameter and compacted in accordance with AASHTO TP-4 to 100 gyrations. The mixing and compaction temperatures shall be those recommended by the PG binder supplier. The mixture shall not contain either reclaimed materials or natural sands.

4. Construction

A. Weather

The Ultrathin Bonded Wearing Course shall not be placed on a wet pavement. The pavement surface temperature and the ambient air temperature shall be not less than 50°F at the time of placement. A damp pavement surface is acceptable for placement if it is free of standing water and favorable weather conditions are expected to follow.

B. Equipment

The paver shall be self-priming, designed and built for applying the Ultrathin Bonded Wearing Course and be approved by the Engineer. The paver shall have a receiving hopper, feed conveyor, asphalt emulsion storage tank, a system for measuring the Polymer Modified Asphalt Emulsion Membrane volume applied, spray bar and a heated, variable width, combination vibratory-tamping bar screed. The paver shall be capable of spraying the Polymer Modified Asphalt Emulsion Membrane, applying the hot mix asphalt overlay and leveling the surface of the mat in one pass. The paver shall be capable of placing the hot mix asphalt within 5 s after the application of the Polymer Modified Asphalt Emulsion Membrane. The paver shall be capable of paving at a controlled speed from 30 - 90 ft./minute. No wheel or other part of the paving machine shall come in contact with the Polymer Modified Emulsion Membrane before the hot mix asphalt concrete wearing course is applied. The screed shall have the ability to crown the pavement at the center and have vertically adjusted extensions to accommodate the desired pavement profile.

C. Surface Preparation

Surface preparation, such as crack/joint sealing and existing pavement marking eradication, as determined by the Owner, will be performed prior to the commencement of paving operations. Surface preparation shall be considered subsidiary to pay item

D. Application

The Polymer Modified Emulsion Membrane shall be sprayed by a metered mechanical pressure spray bar at a temperature of 120 – 180°F or as recommended by the Polymer Modified Asphalt Emulsion Membrane supplier. The sprayer shall accurately and continuously monitor the rate of spray and provide a uniform application across the entire width to be overlaid. The Engineer may make adjustments to the spray rate based

upon the existing pavement surface conditions and the recommendations of the Polymer Modified Emulsion Membrane supplier.

The hot mix asphalt concrete shall be applied at a temperature of 290 – 330°F and shall be spread over the Polymer Modified Emulsion Membrane immediately after the application of the Polymer Modified Emulsion Membrane. The hot asphalt concrete wearing course shall be placed over the full width of the Polymer Modified Emulsion Membrane with a heated vibratory-tamping bar screed. It is highly recommended that paver operations be as continuous as possible with the intent of reducing the possibility of screed indentations in the finished mat. The target application rate of the Ultrathin Bonded Wearing Course shall be stated in the plans. The field application rate shall be as necessary to minimize fracturing of the top size aggregate by the screed. The Engineer shall determine the acceptable extent of fracturing at the edge of the paving for tapering purposes.

E. Rolling

Rolling of the wearing course shall consist of a maximum of three passes with a steel double drum asphalt roller of minimum weight of 10 tons, before the material temperature has fallen below 195°F. At no time shall the roller or rollers be allowed to remain stationary on the freshly placed asphalt concrete. Rolling shall immediately follow the placement of the Ultrathin Bonded Wearing Course with an approved asphalt roller(s). Roller(s) shall be well maintained, in reliable operating condition and be equipped with functioning water system and scrapers to prevent adhesion of the fresh mix onto the roller drums. Adequate roller units shall be supplied so the rolling will be accomplished promptly following the placement of the material. A release agent (added to the water system) may be required to prevent adhesion of the fresh mix to the roller drum and wheels. Rolling shall normally be done in the static mode. Excessive rolling of the driving lanes, to the extent of aggregate degradation, shall not be allowed. The Engineer shall determine the acceptable extent of fracturing at the edge of the pavement from the rolling operation. The new pavement shall not be opened to traffic **nor shall any roller sit idle on the pavement** until the rolling operation is complete and the material has cooled below 160°F.

5. Quality Control

A. Lots and sublots

A lot will be defined as 1320 T. Lots will be further subdivided into sublots not to exceed 350 tons for daily rates less than 1000 tons and 500 tons for daily production rates greater than 1000 tons. Partial sublots will be carried over and added with the next production day quantities to make a complete subplot. Incomplete lots, such as on the last day of production or in other circumstances as deemed by the Engineer, may be closed out by the Engineer.

B. Quality Control

The following measures shall be used by the Contractor to maintain quality control and uniformity. The Contractor will be responsible for obtaining all the quality control (QC) samples. Prior to production, the Engineer/Construction Manager will approve the sampling method used by the Contractor. The Contractor will be responsible for the equipment operation and calibration. The application rate of the Polymer Modified Emulsion Membrane shall be verified by dividing the volume (of Polymer Modified Emulsion Membrane used) by the area of paving for that day.

If the average of three test results vary from the JMF by more than the quality control tolerances in Table 7, production will stop. The Contractor shall identify the cause and document, in detail what corrective action was taken. The JMF may only be adjusted if the revised JMF meets the mixture requirements set forth in the project specifications.

The first sample after the hot mix plant start up shall be taken between loads three and five of production. Sampling of the bituminous mixture for the first sample after the hot mix plant start up shall take place at the hot mix plant, either from the hot elevator or from a transport truck while still at the plant.

For field verification, the General Design Limits shown in Table 6 may be exceeded when the Job Mix Formula has the Quality Control tolerances applied from Table 7.

Table 7 - Quality Control Tolerances*				
% Passing Sieves	Indicated	#4 - Type A	3/8" - Type B	1/2" - Type C
Size		Tolerance, %	Tolerance, %	Tolerance, %
3/4 in		-	-	-
1/2 in		-	-	±5
3/8 in		-	±5	-
#4		±5	±4	±4
#8		±4	±4	±4
#16		±4	-	-
#200		±1.0	±1.0	±1.0
Asphalt Binder Content, %		±0.3	±0.3	±0.3

*All testing must be performed by an AMRL inspected laboratory or be an agency certified laboratory.

C. Acceptance of mixture

At the expense of the Prime Contractor, all quality assurance (QA) sampling and testing, except where stated below shall be performed by an independent (third party) testing firm. Quality assurance testing on bituminous wearing course will be done at the field/Regional laboratory. Quality assurance testing shall be completed in a reasonable time. Sampling and testing methods will be the same as used by the Contractor.

A minimum of one sample per lot of the bituminous wearing course shall be tested for asphalt content and gradation.

Acceptance of mixtures for binder content and gradation for each lot will be determined on the basis of extraction performed by the Engineer. The Engineer will randomly select the location(s) within each lot for sampling.

The test results of the lot shall meet the requirements for tolerances from the JMF for each sieve, shown in Table 7.

If in the Engineer's judgement, defective areas warrant removal, the Contractor shall remove and replace those areas at the Contractor's expense with materials meeting specification requirements.

D. Method of Measurement

The Ultrathin Bonded Wearing Course shall be measured by the number of square yards of pavement surfaced in accordance with this specification.

6. Basis of Payment

The unit price bid per square yard shall include all labor, materials and equipment necessary to complete the work.

Payment will be made under:

Item No.	Item	Pay Unit
1	Ultrathin Bonded Wearing Course	square yd